

Gulf Coast Aerosol Research and Characterization Program (Houston Supersite)

PROGRESS REPORT

EPA Contract No. R-82806201
between the Environmental Protection Agency and the
University of Texas at Austin

Submitted by:

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EPA Agreement No.: R-82806201

Title: Gulf Coast Aerosol Research and Characterization Study

Investigators: Dr. David Allen (PI) and Dr. Matthew Fraser (Co-PI)

Institutions: University of Texas and Rice University

Research Category: Air Quality/Fine Particulate Matter

Project Period: 01/15/00-11/30/03

Objective of Research: Characterize fine particulate matter and fine particulate matter formation processes in Southeast Texas

Progress Summary/Accomplishments:

During the past quarter, substantial progress has been made in four aspects of the Houston Supersite program:

1. *Program Management activities* Subcontracting has been finalized with all of the collaborators cited in the original proposal. Additional subcontracts with new members of the project team have been initiated. Plans for Supersite data management have been coordinated with the data management teams at the other Supersites. The project website has been established, linked to the Texas Air Quality Study (TexAQS) web page (www.utexas.edu/research/ceer/texaqs/).
2. *Quality Assurance and Data Management activities* The Quality Assurance Project Plan has submitted, and revised based on comments from EPA staff. The final version will be signed and approved within the next few weeks. Standard Operating Procedure (SOP) documents have been prepared. Based on discussions with NARSTO, the EPA and data management coordinators at the other Supersites, preliminary data formatting protocols have been defined.
3. *Site Logistics* Supersite sampling will be conducted at three locations. The sites are now ready to accept investigators. The sites are equipped with trailers, power, phones, and sampling towers. The perimeter of each site is secured by fencing. Investigators have begun to arrive and set up equipment.
4. *Preparation for measurements* Each of the teams charged with making measurements during the Supersite program have been assembling their instrumentation, making it ready for deployment in the field.

More detailed lists of accomplishments in each of these areas are attached.

Based on these accomplishments, we anticipate complete deployment of sampling equipment between August 5 and 10, 2000, and collection of valid data within 1 week of equipment deployment. Intensive sampling will begin on August 15.

Program Management Activities

1. Vincent Torres of the University of Texas (vmtorres@mail.utexas.edu) is the Houston Supersite Program Manager. He has managed all site logistics and can take much of the credit for the study's successful, on-time launch. Dr. Elena McDonald-Buller (ecmb@mail.utexas.edu) is the Data Management Coordinator. She has overseen the development of the Quality Assurance Project Plan, and is managing the development of the data archive. Vickie Amidon (vamidon@mail.utexas.edu) is the lead administrator for the Supersite program. She is managing all contracting, subcontracting and accounting for the program.
2. Subcontracting has been finalized with all of the collaborators cited in the original proposal. EPA Contract No. R-82806201 initially had seven Sub-contractors: (1) Aerosol Dynamics; (2) Clarkson University; (3) University of Delaware; (4) Georgia Tech; (5) Rice University; (6) Texas A&M; (7) Texas Tech. Subcontracts have been finalized with each of these organizations. In the last quarter, two additional teams have been added to the study, and consequently, two new subcontracts have been initiated: (i) a team from Lawrence Berkeley Laboratories, led by Lara Gundel, will perform analysis of semi-volatile hydrocarbon species during the intensive sampling period (August-September, 2000). The Supersite will assist with Dr. Gundel's travel expenses and will provide a small fraction of her salary during the sampling period. In addition, Dr. Gundel will be working with two scientists from Environment Canada, and the Supersite will be assisting with the travel expenses for these investigators; (ii) a team from Brookhaven National Laboratory and the State University of New York, led by Barbara Hillery, will be preparing model aerosol streams. These model aerosol streams will be generated on-site during the intensive sampling period and investigators will be able to use these streams of known composition, size and concentration in assessing the responses of their aerosol instrumentation. The Supersite will assist with Dr. Hillery's travel expenses and will provide a small fraction of her salary during the sampling period.

Finally, the Supersite will benefit from the collaboration of a number of EPA scientists during the intensive sampling period. For three of these EPA scientists (Bill Lonneman, Len Stockburger, and Robert Seila), the State of Texas will be providing travel support and funding for supplies. Supersite staff provided assistance in setting up Intergovernmental Personnel Agreements at the University of Texas for these EPA investigators.

3. Plans for Supersite sampling and data management have been coordinated with the sampling and data management plans for a parallel study of ozone formation in Texas (the Texas Air Quality Study or TexAQS-2000). For the past 5 months, weekly conference calls have been held involving the Houston Supersite PI and co-PI (David Allen and Matt Fraser), and the lead TexAQS investigators (Peter Daum of Brookhaven; Jim Meagher, Eric Williams and Fred Fehsenfeld of NOAA; Jim Price of the TNRCC). A 2-day Science Team meeting, involving virtually all TexAQS and

Supersite investigators (approximately 100 individuals), was held in Houston in April.

4. The Supersite website has been established as part of the TexAQS web page (www.utexas.edu/research/ceer/texaqs/). This website has served primarily as a communication vehicle for study participants. Maps and plot plans of sites, daily weather forecasts, background data on emission inventories, logistical information and other information has been disseminated through the website. During the next few weeks, the site will be expanded to include a visitors section.

Quality Assurance and Data Management activities

1. The Quality Assurance Project Plan (QAPP) for the Houston Supersite was submitted to Dennis Mikel and Jeffrey West of the Environmental Protection Agency. Based on their comments, a revised QAPP has been submitted and is awaiting final signatures.
2. Standard Operating Procedures (SOPs), from all members of the Houston Supersite Science Team identified in the original proposal, have been received by the University of Texas at Austin and are included in the Supersite SOP database.
3. Based on discussions with NARSTO, the EPA and data management coordinators at the other Supersites, preliminary data formatting protocols have been defined. Elena McDonald-Buller, the Data Management Coordinator for the Houston Supersite, and Sigurd Christensen of the NARSTO Quality Systems Science Center have begun regularly scheduled conference calls with the Supersite Data Management Coordinators to discuss issues regarding data management and submission of data to the Permanent Data Archive (PDA). While the NARSTO Data Management Handbook is relatively comprehensive, the unique measurements and gaps in existing recommendations related to specific types of Supersite data have motivated the review of these topic areas. The calls have primarily focused on four areas: (1) variable names and formatting, (2) site naming conventions, (3) flags, and (4) access and submission requirements. A summary of topics related to each of the four issues was provided in the last quarterly report.

Site Logistics

Supersite sampling will be conducted at three locations. All of these sites are now ready to receive investigators.

1. Aldine: The Aldine Supersite location will be an expansion of a Texas Natural Resource Conservation Commission site located on Aldine Independent School District grounds. Site diagrams, photos and plot plans are available at the study website. All trailers, fencing, telephone lines and power have been installed.
2. Deer Park/LaPorte: The Deer Park Supersite location will be an expansion of a Texas Natural Resource Conservation Commission site located at a park owned by the City of Deer Park. Site diagrams, photos and plot plans are available at the study website. The Deer Park site will not be occupied until after the intensive is over, in late September. During the intensive, the measurements that would be made at Deer Park will be located at a much larger site approximately 10 kilometers east of the Deer Park site at the LaPorte Municipal Airport. This arrangement was necessary because the full complement of measurements planned for the intensive could not be accommodated at the Deer Park site. Site diagrams, photos and plot plans for the LaPorte site are available at the study website. All trailers, fencing, telephone lines and power have been installed and the site is ready to receive investigators. After the intensive is over, the LaPorte site will be closed down and the more limited measurements that will continue into 2001 will be shifted to the Deer Park site. This is being done to take advantage of the TNRCC measurements performed at the Deer Park site.
3. HRM 3: The HRM 3 Supersite location will be an expansion of a Houston Regional Monitoring (HRM) Network site. HRM is a network of sampling sites funded by local industry; data from these well-instrumented sites collected during the Supersite program will be made public. Additional samplers, beyond those described in the Supersite proposal, have been added to HRM 3. Suzanne Hering of Aerosol Dynamics has agreed to bring a continuous sulfate monitor to this site in August. This monitor will complement identical instruments to be deployed at Aldine and Deer Park. Funding for this monitor has been provided by HRM. Site diagrams, photos and plot plans are available at the study website. All trailers, fencing, telephone lines and power have been installed.

Preparation for measurements

Individual investigators have been preparing their instruments for deployment during the intensive. Separate reports are provided below for the teams from the University of Texas, Rice University, Texas A&M, Aerosol Dynamics, the University of Delaware, Georgia Tech and Texas Tech.

University of Texas

The University of Texas will deploy Low Pressure Impactors (Hering single orifice design) at all three Supersite locations (Aldine, Deer Park/LaPorte, HRM3). During each sampling period (generally every 24 hours), seven fine particle size fractions will be collected on ZnSe disks and the disks will be analyzed using FTIR microscopy at UT. Work during the past quarter has focussed on preparation of the spectrometer and preparation of calibration standards. The samplers have been deployed at each of the sites, and at the time of this report, the first samples had been collected.

(Note that in the original proposal, UT was also responsible for collection of air samples in canisters at the Aldine site and analysis of the samples for VOCs. Since the original proposal, however, the Supersite has arranged for an Auto-GC to be deployed at Aldine, similar to the Auto-GCs deployed at the other two sites. Thus, the canister analysis is no longer required)

Rice University

Rice University will deploy filter samplers at all three Supersite locations. Six ambient samplers have been built from components purchased from various vendors. Three are low volume samplers to collect gaseous samples of ammonia and nitric acid and fine PM on a Teflon membrane filter for analysis for airborne metals. The other three are high volume samplers capable of collecting enough organic material for quantification of individual organic compounds present as molecular markers of primary sources. These samplers use Anderson High Volume TSP bodies with a MSP High Volume Virtual Impactor (HVVI) sampling head to remove all PM larger than 2.5 micron diameter. These samplers have been calibrated (without the HVVI head which we are still waiting for from MSP) at a flow rate of $1.0 \text{ m}^3 \text{ min}^{-1}$. At a flow rate of $1.0 \text{ m}^3 \text{ min}^{-1}$, enough PM will be collected for speciation and for archiving.

The low volume sampler for collection of ammonia and nitric acid has also been tested. Numerous tests were conducted at Rice on the appropriate sampling rates, coating material and contaminant control techniques for the URG annular glass denuders. The best response was with sampling at 15 l min^{-1} for 24 hours using a citric acid coating for ammonia and calcium carbonate coating for nitric acid.

The Rice group has been collaborating with Jamie Schauer of University Wisconsin who will be performing organic speciation work for the St. Louis Supersite program. Dr. Schauer has prepared a suite of isotopically labeled organic compounds to monitor extraction efficiency and aid in quantification. The investigators at Rice will also

participate in the working group for organic speciation, organized by Joellen Lewtas of the US EPA's Office of Research and Development, which has not begun to function.

Georgia Tech

Georgia Tech has been outfitting a Mobile Air Quality Facility for use in the Houston/TEXAQ Study. Included in this outfitting was the further development of the continuous ionic aerosol measurement system and the aerosol optical characteristic analysis system. The Facility, housed in a trailer, is now fully equipped and is being tested in Georgia prior to moving to Texas. In addition, a subcontract to Aerodyne to conduct particle sampling using their MS system was executed. That device is also now in the trailer, and will be transported to Houston for the field study. The major activity in the next quarter is to participate in the field experiment.

Texas A&M

Texas A&M will deploy particle size measurement equipment at LaPorte and Aldine. During the past several months the group at Texas A&M has been designing and constructing the sizing instruments will be employed during GC-ARCH. All of the necessary components have been acquired and construction of the equipment is in its final stages. In parallel with the physical assembly of the instruments, Labview based software is being developed that will provide a real-time graphical display of the data. This will provide a means of immediate comparison with the collocated instruments at each of the three sites. As described in the original proposal, a number of advances have been incorporated into the instrument design that should allow highly accurate measurements of complete size distributions to be made in only a few minutes. To date, the only significant change in the planned operation is that rather than fully drying the aerosol, the relative humidity will be controlled at an intermediate level of about 45%. This modification was due to a consensus among investigators at each of the EPA Supersites that sizing slightly hydrated aerosols will lead to improved accuracy relative to dry measurements.

Aerosol Dynamics

Aerosol Dynamics will deploy near real-time particulate sulfate, nitrate and carbon analyzers at the LaPorte and Aldine sites. These are the same instruments, with minor improvements, that were deployed at the Atlanta Supersite. During the past quarter, the necessary equipment has been acquired and final instrument construction is currently underway.

University of Delaware

The University of Delaware team will deploy a single particle mass spectrometer at the HRM-3 site. During the past quarter, work has focussed on improving the instrument that had been deployed at the Atlanta Supersite. The improvements have included acquiring two new lasers to improve particle hit rates and instrument lifetime, enhancements to the cooling system, and the coding of an algorithm that will allow for particle mass spectra to be categorized in real time. This real time categorization of particles will allow for investigators to assess, as the data are collected, whether a statistically significant number of samples have been collected.

Texas Tech

Texas Tech will deploy trace gas analysis and particle analysis equipment at the HRM3 site. Preparation during the past quarter has been on acquiring and assembling equipment. Equipment was ordered as soon as funds were received. One ion chromatograph has arrived but has not been installed. A second ion chromatograph that was bought using Texas Tech matching funds has also been received and as this report is being written in mid-June, it is being installed. A special scheme has been developed to measure anions and ammonia in a single anion chromatography run. A special pneumatics/fluidics/electronics board has been designed to run this scheme and will fit inside the chromatograph oven. The complete assembly will be tested very soon. As soon as the second chromatograph is installed, the particle collector will be coupled to it and the assembly tested. The mass spectrometer is scheduled to arrive this week. However, the dry nitrogen generator is back ordered without which the unit will not be operational. If the MS is not available, filter samples will be archived for subsequent IC-MS analysis.

EPA's formaldehyde monitor was refurbished to work with more friendly chemistry that NOAA will operate in this study. A second formaldehyde monitor has been designed and built. For reasons unknown, this instrument is more noisy than the other one mentioned above (although more than adequately sensitive to measure HCHO in any urban area) and methods for reducing this noise are being pursued. Reagents needed for both of the above instruments are being purified. An existing hydrogen peroxide monitor has been refurbished and calibrated. A second peroxide monitor will be constructed that will measure both hydrogen peroxide and methyl hydroperoxide.